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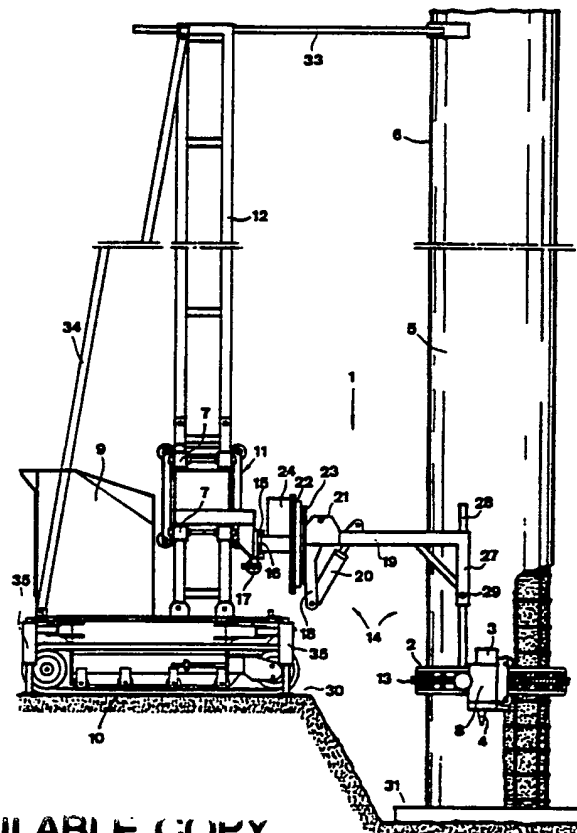
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(54) Title: A DEVICE FOR MATERIAL REMOVING PROCESSING OF SUBSTANTIALLY VERTICAL MATERIAL LAYERS AND METHOD FOR RENOVATING DAMAGED, SUBSTANTIALLY VERTICAL, CONSTRUCTIONS

(57) Abstract

A device for material removing processing of substantially vertical material layers, especially on columns (6) and the like, comprises a carrier (1), a guide (2) arranged on the carrier, a carriage (3) movable to and fro along the guide and carrying a jet tube (4) for directing a high pressure fluid jet towards the material layer, at least a first driving means (7) for driving the carrier vertically so as to move the guide along the substantially vertical material layer, and at least a second driving means (8) for driving the carriage (3) along the guide.



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A device for material removing processing of substantially vertical material layers and method for renovating damaged, substantially vertical constructions.

FIELD OF THE INVENTION AND PRIOR ART

The present invention relates to a device and a method according to the preambles of the appended claims 1 and 11, respectively.

It is today a very serious problem that columns and other substantially vertical constructions located outdoor are subjected to very hard conditions. The columns or the constructions are on one hand at the lower part thereof exerted to phenomena of breakage by freezing. In the case that the columns or constructions are located close to traffic routes there will on the other be an additional factor that the road salt used in the winter has a considerable degradating influence upon the surface layer of the columns or the constructions and then of course in particular at the lower parts of the columns or the constructions.

It will be necessary to carry out a renovation of the columns or the constructions when they have been damaged to a certain extent. The conventional technique used so far is based on the utilisation of hammering machines for renovating such vertical columns or constructions, the disintegrating function of which is based on smashing the material into pieces to a required depth by means of shocks applied on disintegrating tools. The normal way to proceed is to unload the column or supporting construction in question by so called bracing by means of auxiliary support elements. All the damaged material is after that removed from the columns or the constructions by means of the hammering machines and the material in question, generally concrete, is after that repoured or -cast, so that the

columns or the construction is restored. The concrete has to be allowed to cure in a required degree before the bracing may be removed, since the supporting capacity of the column or the construction otherwise could be unsatisfying. In renovating columns and constructions of this kind it is namely normal to remove material around the entire circumference of the column or the construction until a depth which may vary from one case to the other but often is comparatively large. A requirement of bracing during the renovating work often means that it becomes necessary to interrupt the use of the constructional work or building carried by the columns or the constructions, which gives rise to a considerable loss.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a device and a method which make it possible to process and renovate, respectively, substantially vertical material layers on constructions, such as columns and the like, in a rational and efficient way, in which it is with respect to the method especially aimed at the possibility to avoid or at least reduce the extension of such measurements as bracing.

The object of the invention is more exactly obtained by the characteristics defined in the appended claims 1 and 11.

Thus, the device according to the invention makes it possible to carry out processing of the substantially vertical material layer extremely efficiently by the high pressure fluid jet while the carriage carrying the jet tube is moving to and fro along the guide and is also vertically moved.

Advantageous developments of the device according to the invention appear from the dependent claims 2-10.

The inventional method according to claim 11 means that a renovation of the damaged constructions or columns may be rationally carried out in the processing sequence defined, according to which the processing of the damaged surface is divided into two or more processing operations and the surface processed within a certain operation is restored by casting, pouring or injecting material before a further processing operation is carried out on a further damaged surface. The aim of this processing sequence is that the

building or constructional work supported by the supporting construction or the columns has to be ready to be completely or at least partially used in a normal way during the renovating procedure without any need of bracing or supporting or in any case a considerable reduction thereof.

Further characteristics and advantages of the invention will appear from the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

With reference to the appended drawings, below follows a specific description of an embodiment of the invention cited as an example.

In the drawings:

Fig 1 is a schematic side elevation of the device according to the invention,

Fig 2 is a view illustrating the guide of the device in a view from above and applied around a column,

Fig 3 is a schematic view illustrating a possible processing sequence,

Fig 4 is a side elevation illustrating how the processing may be carried out on a column and

Fig 5 is a circuit diagram illustrating the driving of the device.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

The device according to the invention comprises a carrier generally indicated by 1, a guide 2 arranged on the carrier, a carriage 3 movable to and fro along the guide and carrying a jet tube 4 for directing a high pressure fluid jet towards the material layer in question, which in Fig 1 is considered to consist of the envelope surface 5 of a column 6, at least a first driving means 7 for driving the carrier 1 vertically so as to move the guide 2 along the column 6 and at least one second driving means 8 for driving the carriage 3 along the guide 2.

The high pressure fluid supplied to the jet tube 4 is as a rule water. The high pressure fluid is fed to a jet tube 4 through a conduit not shown from a high pressure source 9, which may be arranged on a vehicle 10, which will be explained below.

The carrier 1 comprises a member 11 having the character of a second carriage, which is vertically movable along a substantially vertical path 12 of movement. Although the carriage 3 illustrated along the guide 2 in this example is supposed to be provided with rollers or the like for running on portions of the guide 2, it is to be mentioned that such a construction is not necessary. The carriage 3 could also be arranged to slide along the guide 2 or on the whole move along this in another way, for instance through air cushions, in magnetic fields or the like. The definition carriage in connection with the detail indicated by 3 is accordingly to be interpreted in a broad sense. The corresponding considerations are valid in connection with the carriage 11 movable along the path 12 of movement.

The driving of the carriage 3 along the guide 2 is in the example supposed to be achieved by the fact that the guide 2 has a cog railway 13 into which a cog wheel arranged on the carrier 3 engages, said wheel being arranged to be rotated by means of the driving means 8. However, other driving principals known per se may also be used and corresponding considerations are valid for the carriage 11 movable along the path 12 of movement.

Means collectively indicated by 14 are arranged for interconnecting the carriage 11 and the guide 2. These interconnecting means comprise means 15-21 adapted to provide the guide with a movability in substantially horizontal direction with respect to the carriage 11. The definition "movability" means here adjustability, i.e. that relative positions set are intended to be maintained until a new adjustment is carried out. However, it is mentioned that the definition "movability" may below have another and broader meaning.

The interconnecting means comprise more exactly first means 15-17 for providing the guide 2 with adjustability with respect to the carriage 11 in a first substantially horizontal direction, which extends perpendicularly to the plane of the drawing in Fig 1, i.e. substantially perpendicularly to a vertical

plane passing through the centre of the column 6 as well as the path 12 of movement, and second means 18-21 for providing the guide 2 with movability with respect to the carriage 11 in a second substantially horizontal direction, which makes an angle, preferably an almost right angle, with said first direction. Said second direction shall more exactly have at least a component directed substantially parallelly to said vertical plane and passing through the centre of the column 6 and the path 12 of movement.

The first interconnecting means 15 and 16 have in the example the character of a guide arrangement, the relative direction of movement of which is substantially horizontal and rectilinear. The interconnecting means 15 and 16 comprise more exactly female means 15 and male means 16 received therein and at least a power means 17 acting therebetween and arranged to drive the means 15, 16 for relative movement and by that cause a movement of the guide 2 with respect to the carriage 11. The power means 17 could have any suitable construction, for instance be an hydraulic cylinder.

The second interconnecting means 18-21 are in the example designed to permit pivoting of the guide 2 in a vertical plane directed substantially perpendicularly to the direction of relative movement concerning the first interconnecting means 15-17. The interconnecting means 18-21 have more exactly a first means 18 connected to the carriage 11, second means 19 connected to the guide 2 and a power means 20 acting between these means 18, 19 so as to generate a relative pivoting of the means 18, 20 about a substantially horizontal axis 21. Accordingly, the guide 2 will be pivoted in a substantially vertical plane about said axis 21. In order to obtain the aim of the pivotal movability of the guide 2 about the axis 21, namely a reasonable component of movement directed substantially horizontally and outwardly from the carriage 11, the distance between the axis 21 and the guide 2 should not be too short.

Instead of the second interconnecting means 18-21 described and shown, interconnecting means could be arranged, which form a rectilinear relative displaceability between the guide 2 and the carriage 11 substantially in the horizontal plane and substantially perpendicular to a vertical plane coinciding with the direction of displacement defined by the first interconnecting means 15, 16.

The interconnecting means 14 also comprise means 22-24 adapted to provide a guide 2 with a pivotability with respect to the carriage 11 about a substantially horizontal axis. The axis intended here is intended to be substantially parallel to a vertical plane extending through the centre of the column 6 and the path 12 of movement. The interconnecting means 22, 23 may more exactly be a part of or form a so called pivot ring or crub, wherein said means 22 is connected to the carriage 11 while the means 23 is connected to the guide 2. These two means 22, 23 are pivotable with respect to each other about said axis, which in Fig 2 lies in the drawing plane, and a suitable power means 24 has the task to achieve a relative pivoting between the means 22, 23. This power means 24 may for example be secured with respect to the means 22 and be arranged to drive a cog-wheel or gear engaging into a cog-ring on the means 23.

The end positions of the carriage 3 along the guide 2 are defined by end position components 25 (Fig 2), which are connected to a control unit 26 (Fig 5) arranged to control the driving means 7, 8. The end position components 25 may be switches, inductive transmitters or the like, which detect when the carriage 3 has reached an end position and emit a corresponding signal to the control unit 26, which emits control signals to the driving means 8 for reversing the movement of the carriage 3 and to the driving means 7 so as to start the movement of the carrier 1. The end position components 25 are movable to and securable in desired positions along the guide 2.

In the case of a column of the kind illustrated in Fig 1-4 it is suitable that a guide 2 is made completely or partially annular so as to completely or partially surround the column. The guide 2 is in the case of a complete surrounding of the column of course intended to consist of two or more paths being movable with respect to each other or dismountable from each other, so that the guide 2 may be applied around the column in question and be removed therefrom again, respectively.

The interconnecting means 14 also comprise means 27-29 for providing the guide 2 with adjustable movability with respect to the carriage 11 in substantially vertical direction. These interconnecting means may for example be vertically displaceable with respect to each other and one

means 27 thereof may be connected to the carriage 11 while the other 28 is connected to the guide. Means 29, for instance locking screws, bolts or the like, are present for locking the interconnecting means 27, 28 against a relative movement in the position set. Accordingly, the position of the guide 2 with respect to the carriage 11 may be adjusted by relative movement of the means 27, 28. It is then suitable that the carrier 1 has such a construction that the guide 2 or at least the jet tube 4 is able to decline along the column 6 to a level below that level 30, on which the path 12 of movement is applied. Lower column portions located below said level 30 may by that be processed, preferably all the way down to mounting bases 31 or the like possibly present. The vertical adjustability of the interconnecting means 27, 28 is provided for regulating how far below the level 30 the processing shall be possible to carry out.

It is illustrated in the example how the interconnecting means 27, 28 engage telescopically into each other. It appears from Fig 2 how the carrier 1 may comprise a fork-shaped end 32 close to the guide 2, while a set of interconnecting means 27, 28 allowing vertical adjustments and corresponding locking members 29 are arranged at each fork end.

The substantially vertical path 12 of movement is formed by a guide arrangement arranged on the vehicle 10. The guide arrangement may so as to stabilise the guide arrangement 12 or adjust it into parallelity with respect to the column 6 have a support arrangement 33 intended to support the guiding arrangement with respect to the column 6 and a staying arrangement 34 acting between the vehicle chassis and a point on the guiding arrangement 12 located comparatively high. Particular power means may be present so as to adjust the guide arrangement 12 vertically or otherwise into a desired position. The vehicle 10 is in a conventional way supposed to have arrangement 35 bearing on the ground for unloading the vehicle against the ground.

The driving system illustrated in Fig 5 comprises besides the elements already described means 36 for adjusting the velocity of the carriage 3. In the embodiment driven by compressed fluid, especially hydraulic fluid, meant in Fig 5 the adjusting means 36 is supposed to be a flow regulating valve in fluid conduits belonging to the motor 8. The pressure fluid system according to Fig 5 comprises in a way known per se a pump 37, which de-

livers pressure fluid through the pressure fluid conduits 38 not only to the motor 8 but also to the motor or motors 7. There is also a valve 39 in a pressure fluid supply conduit to the driving means 7, said valve enabling adjustment of the driving speed of the driving means 7 constructed as a pressure fluid motor through flow regulation. Return conduits for pressure fluid from the driving means 7 and 8 may in a conventional way emerge into a pressure fluid reservoir 40, from which the pump 37 is supplied with fluid.

There are control means 41 and 42 for each of the driving means 7 and 8 with a task to start, stop and reverse the direction of the function of the driving means. These control means 41, 42 are in the pressure fluid case illustrated fluid valves which are subjected to control by the control unit 26 through schematically indicated connections thereto.

The control unit 26 is arranged to control the driving means 7 through the control means/valve 41 to move a distance set when the carriage 3 reaches one of its end positions as a consequence of an end position component 25. The speed of this movement is determined by the control means/valve 39. The control units 26 contains a clock adjustable by the operator so as to define the distance of movement aimed at, so that this clock determines the period of time during which the driving means 7 is in function and by that the distance over which the guide 2 is vertically moved.

The device described function in the following way: when a column 6 is to be processed the lower part of the column is layed free by digging should this be required. The vehicle 10 is after that located in an appropriate position with respect to the column 6 and the guide arrangement 12 is erected and adjusted. The guide 2 is after that applied with a carriage 3 applied thereon about the column 2 as indicated in Fig 2 and the guide 2 is located in an appropriate position with respect to the column by means of the interconnecting means 14 discussed. In doing so it is desired to locate the guide 2 so that the geometrical axis thereof will substantially coincide with the geometrical axis of the column 6 or, expressed in another way, so that the guide 2 is located at a distance from the surface of the column 6 being approximately equally long along the entire way to be processed. The operator decides after that how long the movement distance of the

carriage 3 shall be by locating the end position components 25. It is a matter of course that the carriage 3 may be allowed to move 360° around the column in a movement to and fro if desired. However, the operator may as indicated in Fig 2 adjust the end position components 25, so that a smaller angle α than 360° is obtained for the movement of the carriage. The operator decides depending on the actual operating conditions after that the speed of the vertical movement of the carrier 1 by means of the adjusting means 39. By setting the time of duration of this movement in the control unit 26 it is possible to determine the distance of movement resulting. The operator determines the speed of the carriage 3 along the guide 2 by means of the adjusting means 36. When the carriage 3 reaches one of the end positions along the guide 2 the end position component 25 in question is influenced, so that the driving means 7 is activated to raise the carriage 11 along the path 12 and the carriage 3 now moves in the opposite direction along the guide 2 until the other end position is reached, in which a further raising of the carriage 11 along the path 12 takes place and so on.

It is normally recommendable to start processing the lower end of the column and move the guide 2 upwardly as the processing proceeds. It is then suitable to have the jet tube 4 directed obliquely downwardly.

In a method for renovating columns or other similar, substantially vertical, supporting constructions a calculation is carried out for determining a processing sequence allowed with respect to the supporting capacity or admissible load of the column. This sequence comprises at least two processing operations each concerning only one part of the damaged surface on a separate column, wherein after an operation has been carried out but before a further operation is carried out the surface processed in the operation carried out is restored by supply of material and a further operation is not carried out until the material supplied has cured to an extent required for the supporting capacity.

It is normally a question of supply of material by concrete casting or throwing. For the sake of clearness a conceivable situation in which three columns 43, 44, 45 support a schematically indicated building or constructional work 46 lying thereabove, for instance a building deck or a drive way for vehicles, is illustrated in Fig 3. If these columns 43-45 now are dam-

aged, as a rule in the lower part, it is in accordance with the invention proceeded so that the calculation mentioned above is carried out, so that the processing sequence is determined so as to be able to carry out the renovation of the columns without the necessity of stopping the use of the building 46 located thereabove or arranging further bracings or support stands for supporting the building or constructional work 46 during the renovation work. Accordingly, the processing sequence is only so determined that restricted parts of the columns 43-45 are made weaker by removal of material by means of the high pressure tube 4 at each separate location. For instance, may in a first processing sequence each of the columns be processed along the circumferential portion that is indicated by the continuous arrows in Fig 3. The processing is carried out in the vertical direction of the columns over a distance required, and it should be noted that resistance reasons may also here motivate that the work is divided into two or more operations with respect to the processing height of the separate column with intermediate concreting and curing before the remaining portion or portions are renovated. When the columns 43-45 have been renovated along the circumferential portions indicated by the continuous lines and the newly cast concrete material has cured to a sufficient extent the work may proceed through a further operation, during which the columns are processed and provided with new material along the circumferential portions indicated by the dashed arrows. When these circumferential portions have cured and accordingly got the supporting capacity required, a further processing operation will be carried out and so on until it has been taken care of all the column surfaces damaged. The work in such a processing sequence with an intermittent concreting may be carried out extremely rationally by means of the device according to the invention as a consequence of the in particular annular guide 2 and the distance of movement of the carriage 3 along the guide 2 easily adjustable by means of the end position components 25 thereof.

It is illustrated in Fig 4 how the processing by means of the device according to the invention may in specific cases be carried out in different ways in the vertical direction with respect to the processing depth as well as the processing width.

Since there are generally a greater amount of columns, as indicated in Fig 3, a renovation work may be rationally and continuously carried out by

successively moving the device according to the invention from one column to the other so as to carry out the processing required, which is followed by concreting. Thus, the work may be carried on in a rational way.

It is indicated in Fig 2 how it would be conceivable to provide a guide 2 with wheels or other components for position defining bearing against the column or the construction 6. Thus, the idea would here be that these wheels 47 would function in a position defining way with respect to the guide 2 as the carrier 1 is moving along the column or the construction. The interconnecting means between the guide 2 and the carriage 11 would in such a case only have to be adapted for transferring of forces to the guide 2 and besides that provide the guide 2 with a freedom of movement in the horizontal plane, for instance by the interconnecting means 15-21 described, although the power means 17 and 20 would have to be "a floating position", or other similar interconnecting means. However, an embodiment having such support wheels 47 would have to have an adjustability of the support wheels when the column diameter is varied. It would therefor as a rule be more suitable that the support wheels 47 are omitted and that such adjustments of the guide 2 which are required for an appropriate processing result are instead carried out by means of the interconnecting means 14.

It is particularly advantageous that the carrier 1 is so constructed that the guide 2 may be located/is located displaced away from the substantially horizontal pivot axis formed by the interconnecting means 22-24. As has been noted, this results in the possibility to process columns at a very low place, especially below the ground level. Furthermore, processing may then after pivoting the guide 2 and the part of the carrier 1 attached thereto by 180° be carried out on columns at their upper ends and especially all the way up towards the constructional works carried by the columns.

The invention is of course not restricted to the embodiment shown and described here. The guide 2 is in the example shown as circular in correspondence with a substantially circular column. It should be understood that the guide 2 in the case of columns or supporting constructions having another cross-section may be carried out in correspondence thereto. Also other modifications are possible within the scope of the inventional idea.

Claims

1. A device for material removing processing of substantially vertical material layers, especially on columns (6) and the like, **characterized** in that it comprises a carrier (1), a guide (2) arranged on the carrier, a carriage (3) movable to and fro along the guide and carrying a jet tube (4) for directing a high pressure fluid jet towards the material layer, at least one first driving means (7) for driving the carrier vertically so as to move the guide along the substantially vertical material layer, and at least one second driving means (8) for driving the carriage along the guide.

2. A device according to claim 1, **characterized** in that the carrier (1) comprises a member (11) having the character of a second carriage, which is vertically movable along a substantially vertical path (12) of movement, and means (14) for interconnecting the carriage and the guide.

3. A device according to claim 2, **characterized** in that the interconnecting means (14) comprise means (15-21) adapted to provide the guide with a movability in substantially horizontal direction with respect to the second carriage (11).

4. A device according to claim 3, **characterized** in that the interconnecting means (14) comprise first means (15-17) for providing the guide (2) with a movability with respect to the carriage in a first substantially horizontal direction and second means (18-21) for providing the guide (2) with a movability with respect to the carriage (11) in a second substantially horizontal direction, which makes an angle, preferably an almost right angle, with the first direction.

5. A device according to claim 2, **characterized** in that the interconnecting means (14) comprise means (22-24) adapted to arrange the guide (2) pivotally with respect to the second carriage (11) about a substantially horizontal axis.

6. A device according to claim 4,

characterized in that the interconnecting means (14) comprise third means (22-24) adapted to arrange the guide pivotally with respect to the second carriage about a substantially horizontal axis.

7. A device according to any of the preceding claims,
characterized in that the end positions of the carriage along the guide (2) are defined by end position components (25) connected to a control unit (26) arranged to control the driving means.

8. A device according to any of the preceding claims, especially for processing of columns and the like,
characterized in that the guide (2) is made completely or partially annular so as to completely or partially surround the column.

9. A device according to claim 2,
characterized in that the interconnecting means (14) comprise means (27-29) for providing the guide with a movability with respect to the carriage in a substantially vertical direction.

10. A device according to claim 2,
characterized in that the substantially vertical path (12) of movement is formed by a guide arrangement arranged on a vehicle (10).

11. A method for renovating damaged, substantially vertical, supporting constructions, such as columns (6) and the like,
characterized in that the method is carried out by means of a device for material removing processing, which comprises a carrier (1), a guide (2) arranged on the carrier, a carriage (3) movable to and fro along the guide and carrying a jet tube (4) for directing a high pressure fluid jet towards the construction, at least a first driving means (7) for driving the carrier vertically so as to move the guide along the substantially vertical material layer, and at least a second driving means (8) for driving the carriage along the guide, the end positions of said carriage along the guide being defined by end position components (25) connected to a control unit (26) arranged to control the driving means and the guide being arranged to extend along the material layer to be processed, that a calculation is carried out for determining a processing sequence allowed with respect to the supporting capacity on the construction, said sequence comprising at least two

processing operations each concerning only a part of the damaged surface, wherein after carrying out one operation, but before a further operation is carried out, the surface processed in the operation carried out is restored by supplying material and the further operation is not carried out until the material supplied has cured to an extent required for the supporting capacity.

12. A method according to claim 11, characterized in that a separate processing operation is provided to comprise processing of a construction or a column (6) only along a restricted part of the circumference by arranging the end position components (25) on the guide (2) in correspondence with said restricted part.

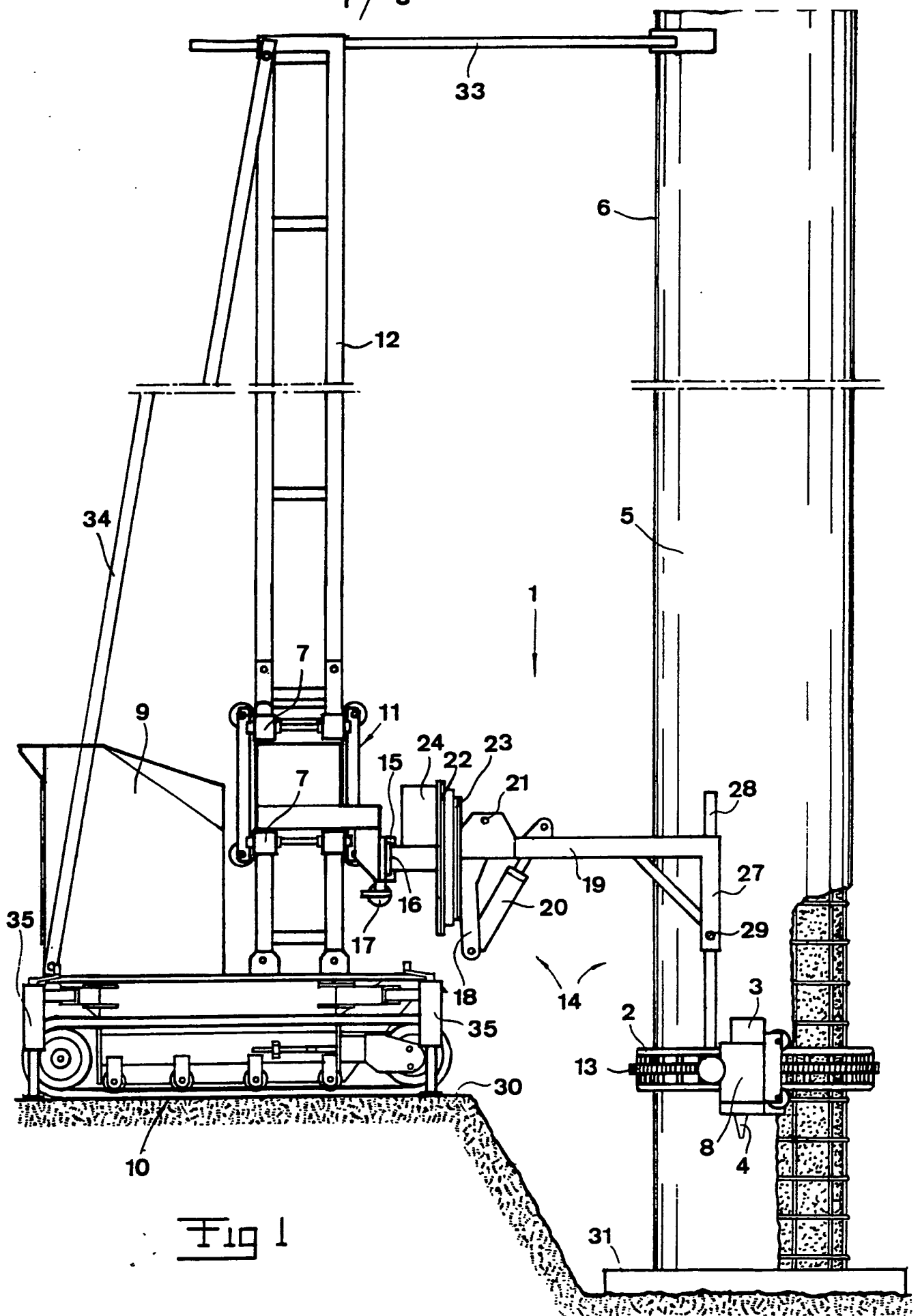


Fig 1

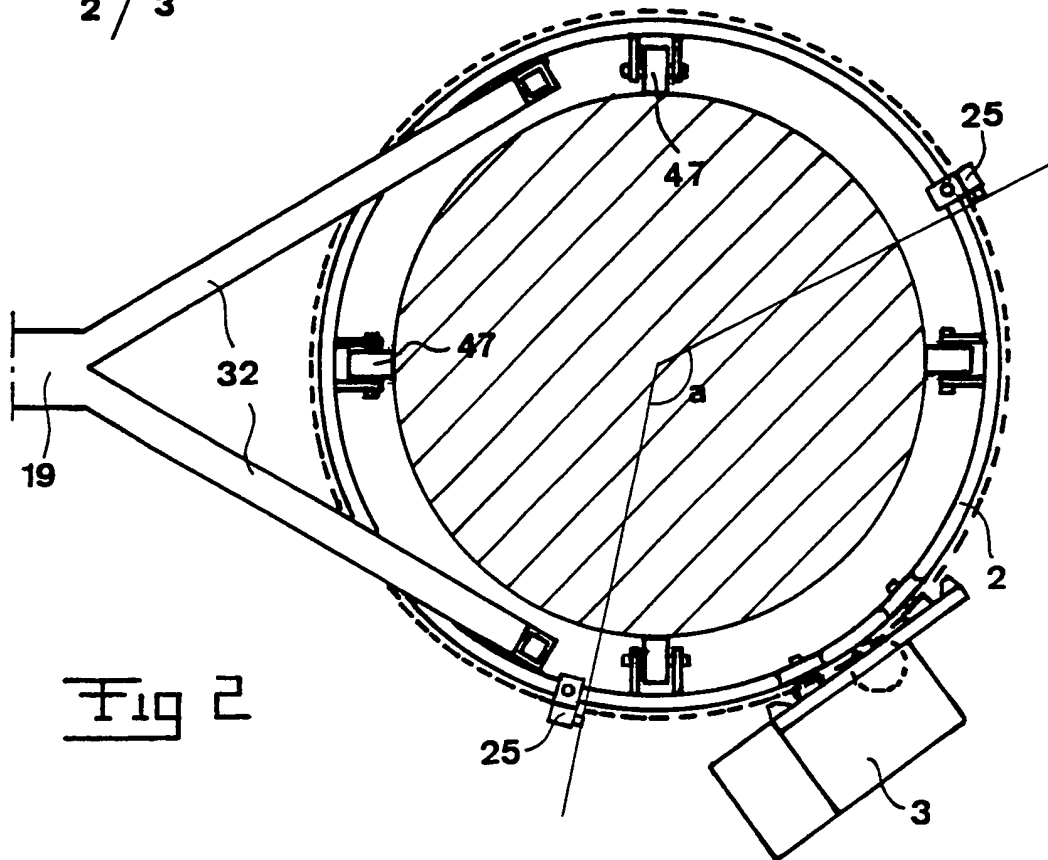


Fig 2

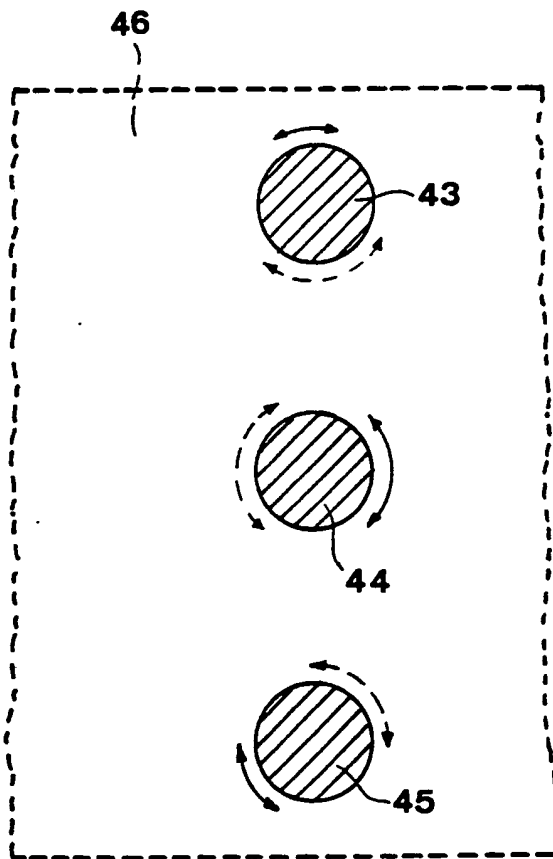


Fig 3

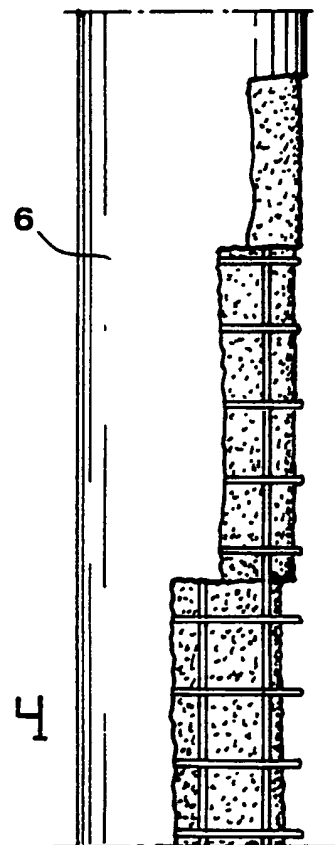


Fig 4

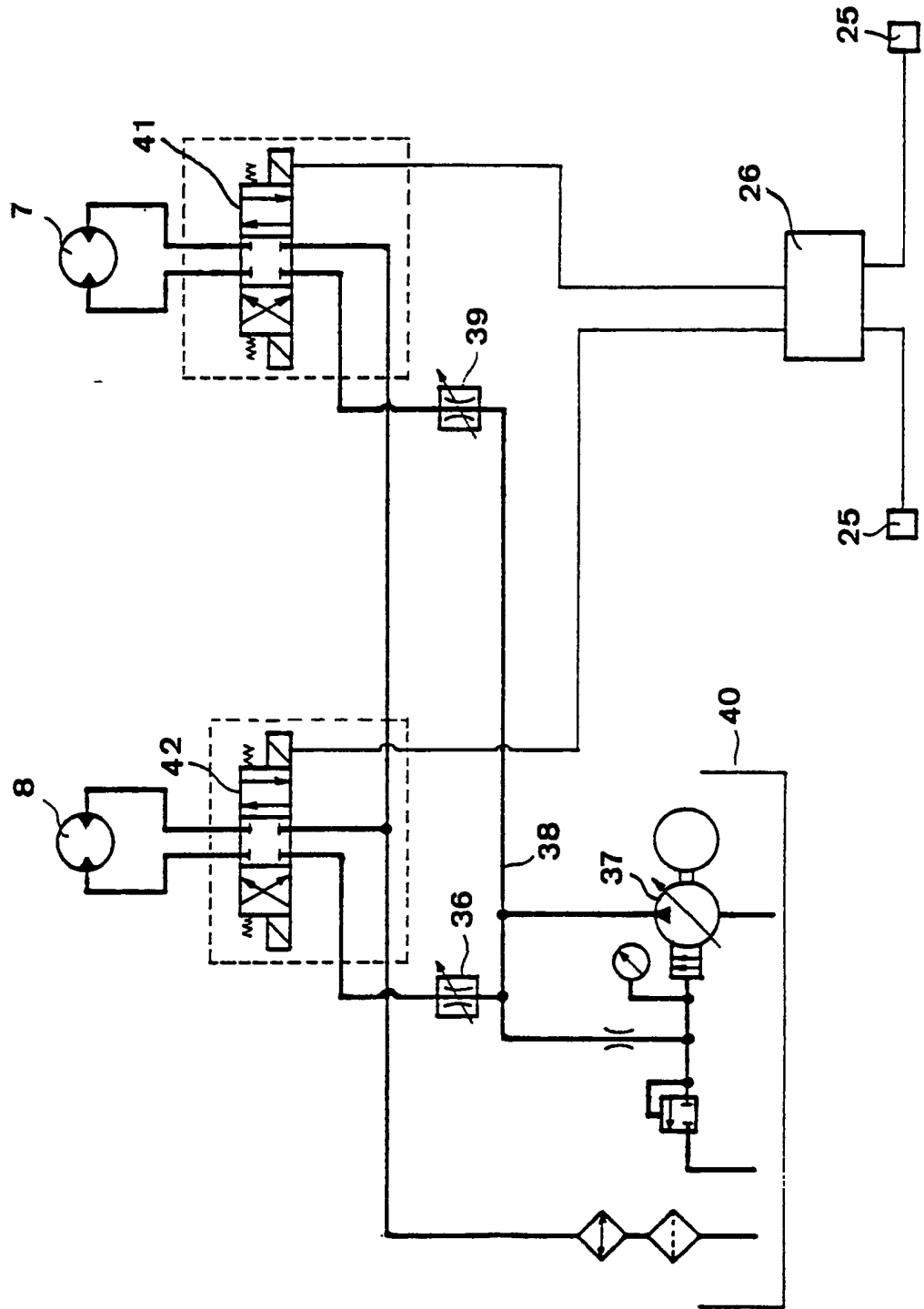


Fig 5

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 92/00752

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁵ According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: E04G 23/02								
II. FIELDS SEARCHED <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Minimum Documentation Searched⁷</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 20%; border: 1px solid black; padding: 2px;">Classification System</th> <th style="border: 1px solid black; padding: 2px;">Classification Symbols</th> </tr> <tr> <td style="border: 1px solid black; padding: 10px; vertical-align: top;">IPC5</td> <td style="border: 1px solid black; padding: 10px; vertical-align: top;">B25D; E02D; E04G</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched⁸</div> <p style="padding: 10px;">SE,DK,FI,NO classes as above</p>			Classification System	Classification Symbols	IPC5	B25D; E02D; E04G		
Classification System	Classification Symbols							
IPC5	B25D; E02D; E04G							
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹ <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; border: 1px solid black; padding: 2px;">Category *</th> <th style="width: 60%; border: 1px solid black; padding: 2px;">Citation of Document,¹¹ with indication, where appropriate, of the relevant passages¹²</th> <th style="width: 30%; border: 1px solid black; padding: 2px;">Relevant to Claim No.¹³</th> </tr> <tr> <td style="border: 1px solid black; height: 300px;"></td> <td style="border: 1px solid black; height: 300px;"></td> <td style="border: 1px solid black; height: 300px;"></td> </tr> </table>			Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³			
Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³						
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>* Special categories of cited documents:¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"Z" document member of the same patent family</p> </div> </div>								
IV. CERTIFICATION <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border: 1px solid black; padding: 5px;"> Date of the Actual Completion of the International Search 3rd February 1993 </td> <td style="width: 50%; border: 1px solid black; padding: 5px;"> Date of Mailing of this International Search Report 05 -07- 1993 </td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;"> International Searching Authority <div style="text-align: center;">SWEDISH PATENT OFFICE</div> </td> <td style="border: 1px solid black; padding: 5px;"> Signature of Authorized Officer <div style="text-align: center;">Ake Olofsson</div> </td> </tr> </table>			Date of the Actual Completion of the International Search 3rd February 1993	Date of Mailing of this International Search Report 05 -07- 1993	International Searching Authority <div style="text-align: center;">SWEDISH PATENT OFFICE</div>	Signature of Authorized Officer <div style="text-align: center;">Ake Olofsson</div>		
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